

PRELIMINARY GEOLOGIC MAP OF THE DEVILS THROAT QUADRANGLE, CLARK COUNTY, NEVADA

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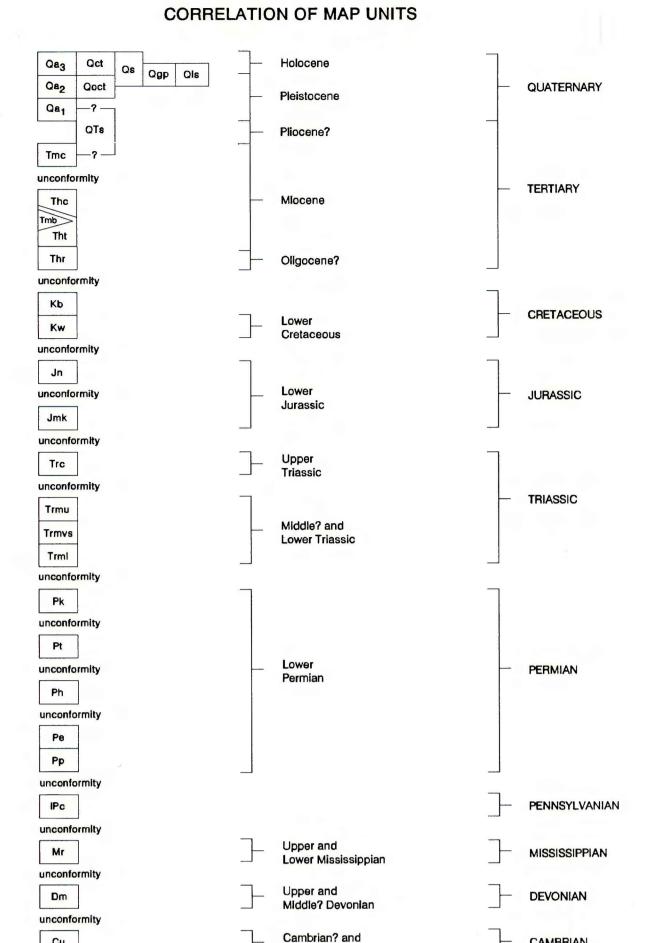
1991

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1. Beard, L. Sue, unpublished mapping, 1989-90 2. Campagna, D. J., unpublished mapping, 1989 slightly modified by Beard, 1989. 3. Morgan, (1968), modified by Beard, 1989.



DESCRIPTION OF MAP UNITS

[Differentiated chiefly by photogeologic

Middle Cambrian

Alluvial deposits (Holocene) -- Gray to tan or red-tan, unconsolidated, poorly sorted boulders, cobbles, sand, well as undissected alluvial fan and alluvial plain deposits that are typically underlain by pediment surfaces. Thickness ranges from 5 to probably more

than 50 m Qct Colluvial, talus, and rockfall deposits (Holocene) --Unconsolidated, very poorly sorted, locally derived slope wash, talus, and rockfall material. Thickness 0 to 10 m Dune and sand sheet deposits (Holocene and Pleistocene?) -- Redorange, unconsolidated, well-sorted eolian sand deposited as dunes and sand sheets. Deposits confined to northwest part of quadrangle; sand derived mostly from nearby or underlying Navajo Sandstone. Thickness about 0 to 5 m Gypsiferous deposits (Holocene and Pleistocene?) -- Includes two exposures of white to gray, massive bedded, sandy, calcareous gypsum near trace the Lime Ridge Fault system in outcrops is south of Devil's Throat. The gypsum surrounds and overlies the Moenkopi Formation, from which the bulk of the gypsum was probably derived. The northwest edge of the deposit parallels the trace of the fault, suggesting that either the northwest extent of the deposit was confined by

the fault trace or the deposit was faulted. The smaller outcrop, north of Devil's Throat, is dissected by modern alluvial channels. Exposed thickness 0 to 10 m Landslide deposits (Holocene and Pleistocene?) -- Unconsolidated, very poorly sorted, unstratified, house-size blocks, boulders, cobbles, sand, silt, and clay, derived from rocks immediately upslope from deposits. Deposits have hummocky topographic expression and lobate shape. Thickness 0 to

Moderately dissected alluvial deposits (Holocene to Pleistocene) -- Unconsolidated, poorly-sorted material similar to unit Qa3, but moderately dissected and topographically higher than nearby Qa3 deposits. Outcrop patterns indicate unit was deposited mostly on alluvial plains. Thickness

about 0 to 30 m Qoct Older colluvial, talus and rockfall deposits (Holocene and Pleistocene) -- Isolated deposits of unconsolidated, very poorly sorted, locally derived slope-wash, talus, and rockfall material. Topographically higher or further from slopes than Qct deposits. Thickness 0 to 15 m

Dissected alluvial deposits (Pleistocene) -- Slightly to moderately consolidated, isolated, alluvial plain deposits that are lithologically similar to Qa, and Qa, deposits, but dissected and topographically higher. Best developed where underlain by conglomerate of the Thumb member (Thc) of the Rainbow Gardens Formation. Thickness 0 to 25 m or more Moderately dissected sandy alluvial fill (Pleistocene, Pliocene, or Miocene?) -- White to pinkish-white, fine-grained, calcareous-cemented sand and silt deposits; mostly derived from Navajo Sandstone. Deposits fill drainage system cut through Navajo Sandstone in vicinity of Red Rock Springs, now moderately dissected. Probably of similar age to Qa,

but possibly marginal facies of Muddy Creek Formation. A maximum fill level, the Muddy Creek may have extended into this part of the quadrangle prior to post-Muddy Creek erosion. Thickness 0 to 5m BEDROCK UNITS Muddy Creek Formation (Miocene) -- Pale-tan to red- or orange-tan, poorly to moderately consolidated, conglomerate, sandstone, and siltstone, with minor gypsum and claystone. Exposed

slip fault. Thickness unknown, probably as much as 500 to Horse Spring Formation (Tertiary) -- Includes, in descending order, the Thumb and Rainbow Gardens members (Bohannon,

only in northwest corner of map along Bitter Ridge strike-

Thumb Member (Miocene) -- Divided into two units for mapping purposes, in descending order: a conglomerate and sandstone unit, and a sandstone, siltstone, gypsum and limestone unit Conglomerate unit (Miocene) -- Red-tan to pale-brown conglomerate, sandy conglomerate and conglomeratic sandstone, poorly exposed. Overlies and possibly interbedded with the lower Thumb unit (Tht). Placed within the Thumb member here but may include younger deposits. Clast types and sizes vary stratigraphically both upward and laterally. Clast types include the following: Precambrian gneisses, foliated granites, and schists that match rock types exposed in Whitney Ridge a few miles east of the quadrangle; Paleozoic carbonate and to a lesser extent, clastic rocks; and minor well rounded quartzite and chert pebbles and cobbles that are probably recycled from Mesozoic conglomerates. Clasts range mostly from pebble- to cobblesize, although boulders up to 1 m diameter are found. In the northern exposures clasts of Precambrian rock dominate lower 10-20 m of section, and are overlain by an influx of clasts of Paleozoic rock. In southern part of quadrangle,

just north of the Lime Ridge fault, Paleozoic clasts dominate throughout the exposed section. Maximum thickness

unknown, but probably at least 350 m

Sandstone, siltstone, gypsum and limestone unit-Stratigraphy of lower Thumb unit complicated due to rapid facies changes and structural disruptions, but in general consists of lacustrine and alluvial facies (Bohannon, 1984) Dominant rock types are sandstone and siltstone, with local thick pure deposits of gypsum; also contains limestone and thin reworked airfall tuffs. Total thickness difficult to determine but as much as 500 m Sandstone and siltstone units -- includes brown, finegrained, well-sorted sandstone or siltstone in thin, parallel continuous beds which are commonly calcareous, sometimes ripple-laminated, sometimes with thin granule or pebbly layers. Elsewhere, clastic rocks are brown to red, fine- to coarse-grained sandstone and siltstone, commonly cross-stratified, with parallel to lenticular bedding and thin, channel-filling conglomeratic sandstone beds. Locally includes medium to thick beds of structureless to crudelystratified, poorly-sorted sandstones with floating pebbles Gypsum unit--White to gray gypsum occurs in laterally continuous, even- to wavy-bedded, thick layers that are finely laminated or massive and recrystallized. Gypsum layers typically pure, but locally can contain sandstone and Limestone unit--yellow-tan to yellow-gray, very thin- to thin-bedded with laminated structure. Locally these limestones contain raindrop impressions and desiccation cracks on bedding surfaces. Limestone occurs in minor amounts except for one thick deposit (about 40 m thick and exposed for about 300 m laterally) in the east central part

Tuff beds are massive and structureless or channel-filling and crossbedded; occur as thin to thick beds throughout most of the section. Beds range in thickness from a few cm to 5 Mega-breccia bed -- Two isolated lenticular deposits of monolithologic breccia interbedded with Tht, in southeast part of quadrangle. Western deposit composed of several slightly disrupted blocks of Mesozoic sandstone and shale Eastern deposit consists of several blocks, poorly exposed beneath Qa1, of basal conglomerate and/or carbonate of the Rainbow Gardens Formation (Thr) that are as much as 10 m

of the quadrangle, that grades laterally into gypsum

Tuff unit--pale-green to white or gray, fine-grained,

hornblende, sanidine and plagioclase; sometimes contain

lithic fragments and commonly reworked at base and top.

airfall tuffs with rare to common phenocrysts of biotite

long and several m thick Rainbow Garden Member (Miocene to Oligocene?) -- consists of three units: a resistant basal conglomerate, overlain by a slope-forming, lithologically variable unit of sandstone, siltstone and limestone, and capped by a cliff-forming, nonmarine limestone unit. Unit typically faulted, but maximum total thickness probably about 300 m Basal unit -- Dark-brown to red-brown, pebble to cobble conglomerate, composed almost exclusively of subangular to subrounded, poorly- to non-imbricated, carbonate and chert clasts of Paleozoic rock, in a calcareous, sandy matrix. The conglomerate lies on a surface that gradually truncates, from north to south, the underlying Cretaceous deposits and Jurassic Navajo Sandstone (Bohannon, 1984). Gradational contact with overlying unit. Thickness about 1 to 5 m Middle unit -- Includes green-white or red, thin bedded, lithic sandstone; some beds contain abundant, small (2-4 cm) black chert pebbles. Green-gray, thick-bedded, claystone with floating chert pebbles occurs locally with the lithic sandstones. Red-orange to orange-tan, thin-bedded, calcareous siltstone and silty limestone are commonly found just above the basal conglomerate, and pink to red, vuggy, crystalline limestone with vertical calcite-filled tubelets (see Bohannon, 1984) typically occur at the contact with the overlying limestone unit, which is gradational Upper limestone unit -- White to pink-white, coarsely crystalline limestone; poorly bedded in the lower part, grading upward into gray, fine-grained to micritic, medium-

to thin-bedded limestone. Contact with overlying Thumb Baseline Sandstone (Cretaceous) -- Red, purple-red and yellow-tan, fine-grained quartz sandstone; medium-bedded, commonly cross-bedded. Lithologically similar to and probably derived from Navajo Sandstone. Rests conformably on Willow Tank Formation. Occurs only in north-central part of quadrangle where overlain with gentle (1-2) angular unconformity by Rainbow Gardens Member of Horse Spring Formation (Thr). Considered equivalent to Baseline Sandstone (Bohannon, 1979) exposed in the Muddy Mountains to

the west of the quadrangle because of similar lithology to and stratigraphic setting as Baseline. Thickness 0 to 60 m Willow Tank Formation (Cretaceous)--Variegated light- to darkgray, tan, and red claystone, with interbedded, lenticular bodies of brown and yellow-brown sandstone. Sandstone in lower part of formation is in part conglomeratic, with sparse to abundant, small (2-4 cm) clasts of black and gray chert, red-brown quartzite, and orange-brown pebbly lithic sandstone. Pale-brown, moderately rounded, cobble conglomerate occurs very locally at base. Includes clasts (5-20 cm diameter) of quartzite, carbonate, and chert in a sandy matrix. Unconformable contact with underlying Navajo andstone Thickness ranges from about 0 to 100 m Jn Navajo Sandstone (Lower Jurassic) -- Red, less commonly white or pale-yellow, medium- to fine-grained, eolian quartz sandstone. Bedding discontinuous, nonparallel, with distinctive large-scale (up to 15 m thick) planar crossstratification except near base of unit where thinner (0.5 2 m), low-angle tangential cross-stratification bedding

erosion. Thickness ranges from over 900 m at north end of the quadrangle to less than 280 m in the southern part Jmk Kayenta and Moenave Formations (Lower Jurassic) -- Kayenta Formation (upper of two formations) is red and orange sandstone and siltstone, with medium to thick parallel beds with large-scale cross-stratification. Bleached spots, 1-2 cm diameter, common in siltstone layers. The Moenave Formation is brick-red sandstone and siltstone, with minor thin limestone beds and local gypsiferous claystone. Base of formation commonly marked by dark red-brown to greenbrown, trough-cross-stratified, pebble conglomerate. Clasts are mostly well-rounded, highly polished quartzite and chert, but also include limestone and sandstone. Where conglomerate missing, lower part of unit is dominated by lenticular deposits of gypsiferous claystone. Underlain by erosional unconformity on Chinle Formation. Thickness about

common. Variable thickness due to pre-Rainbow Gardens

Trc Chinle Formation (Upper Triassic) -- Includes in descending order, the Petrified Forest and Shinarump Members. Thickness of Chinle Formation about 250 m Petrified Forest Member -- Chocolate-brown, gray, and pale-red to pale-purple, interbedded sandstone, siltstone, and claystone. Bentonitic clay derived from volcanic ash occurs in some of the mudstones Shinarump Member -- Yellow- or green-brown to dark red-brown conglomerate, conglomeratic sandstone and sandstone. Includes well-rounded to rounded chert, quartzite, and minor carbonate clasts. Forms unconformable contact with underlying Moenkopi Formation Moenkopi Formation (Middle? and Lower Triassic) -- Includes in descending order: the upper red, Shnabkaib, middle red, Virgin and the lower red members, as defined by Steward and

others (1972). The middle red is only intermittently present. Two formal members have been mapped separately, the lower red (Trml), and the upper red (Trmu). The Shnabkaib, middle red, and Virgin are mapped as one informal unit (Trmsv). Thickness of Moenkopi ranges from about 600 Trmu Upper red member--red shale, gypsiferous, interlayered with thin, resistant, red-brown, ripple-laminated, fine-grained sandstone and siltstone; poorly exposed. White to yellowbrown, fine-grained sandstone lenses with rare, small floating chert pebbles are found in the lower half. Also includes a purple and white mottled conglomeratic sandstone

that occurs locally about 5-10 m below the top of the Moenkopi. Above sandstone are very red-brown, thin massive mudstone to siltstone beds, separated by thin recessive green shale with vertical silt-filled mudcracks. Gradational contact with underlying Shnabkaib member Trmvs Shnabkaib, middle red, and Virgin Limestone Members, undifferentiated -- Aggregate thickness about 200 m Shnabkaib member -- thin interlayered beds of white gypsum, gray limestone, and pale-green or -red siltstone and shale Middle red member -- present only locally between the Virgin and Shnabkaib. Unit is interbedded, pale red-brown, laminated to structureless, siltstone and shale Virgin Limestone member -- composed of light-gray to yellow-

gray, fine-grained to aphanitic, thin-bedded dolomite and limestone, interbedded with gray or green-gray siltstone. Commonly crops out as two resistant ridges, separated by a Trml Lower red member--pale-red to red-brown gypsiferous shale interbedded with dark-red or red-brown, ripple-laminated, siltstone and fine-grained sandstone; generally very poorly exposed. A limestone-clast breccia to conglomerate occurs locally at the base of the lower red where it fills erosional channels cut into the underlying Kaibab Limestone. This conglomerate is probably equivalent to the Timpoweap

Member of the Moenkopi in southwestern Utah Kaibab Formation (Lower Permian) -- Includes, in descending order, the Harrisburg and the Fossil Mountain Members, as defined by Sorauf and Billingsley (in press). Thickness is variable due to sub-Triassic unconformity, ranging from 120 to 170 m Harrisburg Member--White-gray to gray and light-red, interbedded limestone, dolomite, gypsum, and siltstone. The gypsum and siltstone is usually slope-forming and the limestone and dolomite form ledges so that the member has a stair step geometry Fossil Mountain Member -- Pale yellow-brown to gray, mediumto thick-bedded limestone; fossiliferous with brachiopods, bryozoans, gastropods, bivalves, corals, and crinoids. Chert is very common, occurring as nodules, ribbons, or fine disseminated networks. Typically forms a cliff

Ptc Toroweap Formation and Coconino Sandstone, undifferentiated (Lower Permian) -- Includes, in descending order, the Woods Ranch, Brady Canyon, and Seligman Members of the Toroweap Toroweap Formation -- Total thickness about 110 m Woods Ranch member -- White to yellow-gray or medium-gray, interbedded gypsum, calcareous siltstone and sandstone, and minor limestone and dolomite. Forms slope Brady Canyon member -- Medium gray, thick-bedded limestone and dolostone; cliff-former. Fossil fragments, especially

crinoids and brachiopods, are common as are rounded nodules and ribbons of chert. Has gradational contact with overlying Woods Ranch and underlying Seligman members Seligman member -- Tan to red- and yellow-tan or gray-orange slope-forming unit that contains siltstone, sandstone, and limestone; locally, thick gypsum deposits dominate unit. Forms a disconformable contact with underlying Coconino Coconino Sandstone -- white to buff-colored, coarse- to mediumgrained sandstone with 1 m crossbedded sets; forms a cliff

when present. Has a sharp unconformable contact with the

underlying Hermit Shale. Unit is thin to nonexistent (15-0 m) throughout the study area Hermit Shale (Lower Permian) -- Brick-red to red-brown, thin- to medium-bedded, fine-grained, in part cross-stratified sandstone and siltstone, interbedded with deep-red, structureless to ripple-laminated, shaly siltstone. Forms steep slopes that are commonly covered by talus and colluvium. Unconformable contact with underlying Esplanade Sandstone. Thickness ranges from about 270 to 300 m Esplanade Sandstone (Lower Permian) -- White to pink or pale-red, fine- to medium-grained, well-sorted, medium- to thick-

bedded, well-sorted sandstone. Exhibits both large-scale planar cross-stratification and low-angle, tangential crossstratification in thin sets. Basal 20 ft of formation typically consists of red shale interbedded with red sandstone and pale-red gypsum; thin-bedded. Contact with underlying Pakoon Limestone is conformable and gradational where upper Pakoon contains abundant gypsum. Thickness Pakoon Limestone of McNair (1951) (Lower Permian) -- White to light-gray, fine- to coarse-grained, thin- to medium-bedded, cherty dolomite. Gypsum is commonly, but not always,

interbedded with gypsiferous dolomite in the upper 15-20 m. Unit weathers into ledge-slope, with slightly gentler topographic profile than underlying Callville Limestone sconformable, locally erosional contact with Callville Thickness about 120 to 140 m

Callville Limestone (Pennsylvanian)--Medium-gray, medium-grained, cherty, fossiliferous limestone; interbedded with light-gray, fine-grained dolomite and calcareous sandstone or shaly siltstone that weathers orange. Cliff-forming limestone and slope-forming sandstone and siltstone create stair step topography. Chert occurs as red nodules and stringers; most abundant in the middle part. Dolomite

Forms unconformable contact with underlying Redwall Limestone. Thickness about 140 to 200 m Redwall Limestone (Upper and Lower Mississippian) -- Medium-gray, fine-grained to coarsely crystalline, fossiliferous limestone that forms a massive cliff. Distinctive banded chert unit, about 45 m above base of formation, contains 5-10 cm thick bands of white to gray chert that weathers vellow and black and forms a distinctive marker bed. Locally dolomitized. Has disconformable contact with

increases in proportion to limestone toward top, and

sandstone is more common in the upper half of the formation.

underlying Temple Butte Limestone. Thickness about 140 m Dtb Temple Butte Limestone (Upper and Middle? Devonian) -- Upper part is light-gray, fine-grained to micritic limestone that weathers to very light-gray and forms a cliff. Commonly dolomitized and characteristically has strong fetid odor fine-grained dolomite, with interbedded red-brown sandstone and sandy shale in the lower 10 m. Dolomite forms cliffs and sandstone forms slopes creating a stair step topograph Basal contact is erosional unconformity. Thickness about 6u Unclassified Dolomite and Muay Limestone, Undifferentiated

(Cambrian? And Middle Cambrian) -- Combined thickness (incomplete) about 180 m

Unclassified Dolomite -- Light-gray to medium-gray or lightbrown, medium-grained to coarsely crystalline dolomite and sandy dolomite; shale partings common in lower part of section. Thin- to medium-bedded, with beds even and continuous. Fine laminae and mottling typical on weathered surfaces. Upper 30 m is yellow-brown glauconitic dolomite; previously mapped as Pogonip Group rocks of Ordovician age (Morgan, 1968, Seager, 1966) because McNair (1951) found small fragments of brachiopods and trilobites possibly younger than Cambrian at Whitney Ridge (about 6 km east of quadrangle). However, these beds included here with classified Dolomites based on 1) Cambrian(?) fossils (F.G Poole, oral commun., 1988) found in same interval on Whitney Ridge and 2) stratigraphic correlations by S.M. Rowland (written commun., 1990). Contact with underlying Muav is

Muav Limestone--Medium- to dark-gray, coarse- to mediumgrained, medium- to thin-bedded dolomite, interbedded with thin-bedded light-gray or white sandy dolomite, and gray, weathered surfaces because of extensive burrowing. Disconformable contact between Unclassified Dolomite and

Contact--dashed where approximately located

Fault -- Dashed where approximately located, queried where show direction and amount of dip; diamond-tipped arrow and number show trend and plunge of slickenlines Normal, fault at moderate to high-angle to bedding--Bar

and ball on downthrown side; ball open where normalseparation fault, solid where slip direction determined from slip indicators Normal, fault at low-angle to bedding--Double tick marks indicate upper plate

Attenuation, fault parallel to bedding--In limbs of folds where strata missing due to attenuation caused by folding; single tick mark indicates upper (younger) Lateral -- Arrows indicate strike separation where sense of

motion inferred, bar on arrow indicates slip direction

determined from slip indicators and offset elements

Thrust--Sawteeth on upper plate; displaces older over Anticline--Showing trace of axial plane and direction of

plunge, dashed where approximately located, dotted Syncline -- Showing trace of axial plane, dashed where

approximately located, dotted where concealed Monocline -- Axial trace located approximately between synclinal and anticlinal hinges of fold, dotted where

Strike and dip of beds Vertical

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